BIOGRAPHY

PAUL BERT'S TRIUMPH

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A splendid English translation of Paul Bert's great classic on aviation medicine *La Pression Barométrique, Recherches de physiologie expérimentale* has just come off the press, 65 years after the book was first published, and 59 years after the death of the author.[1] This is, as Dr. J. F. Fulton states in his foreword, a triumph of American scholarship in wartime for which thanks are due mainly to the translators and the publisher. But that a scientific book should be translated and re-edited after 65 years, not for historical but for practical reasons, is a still greater triumph for the author himself, a triumph no other 19th century physiologist has achieved so far or is likely to achieve. As there exists almost nothing on Paul Bert in English, and little more in French, it seems worth while to collect at least the elementary data on Paul Bert—the man, his work and his background.[2]

We are by no means blind to the fact that Paul Bert's triumph is to a great extent due to two fundamentally extrascientific factors: first, the necessities of this war, fought for a large part in the air; second, the sad and costly neglect during decades of aviation physiology in general, and of Paul Bert's work in particular. We by no means desire to follow the method of certain historians who make a first-rate man out of a second-rate man, genius out of talent, just because he enjoys the doubtful privi-

[1] *Barometric Pressure.* Researches in Experimental Physiology by Paul Bert. Translated from the French by Mary Alice and Fred A. Hitchcock. College Book Company, Columbus, Ohio, 1943. xxxii + 1055 pp., 89 fig. $12.00.

[2] In English we know only of Dr. J. F. Fulton's short foreword to Hitchcock's translation and of some very pertinent remarks in Victor Robinson's excellent series on Aviation Medicine in *Ciba Symposia*, vol. 5, no. 9, Dec. 1943. Berts' work as colonial administrator is well described in Stephen H. Robert's *History of French Colonial Policy*, vol. II, p. 439-445, London, 1929. In French the only more extensive works on P. Bert are E. Bérillon's *L'œuvre scientifique de Paul Bert*, Paris, 1887, and Jean Ducloz' L'enfance et la jeunesse de Paul Bert (*Bull. Soc. Sc. Hist. et Nat. de l'Yonne*, vol. 78, pp. 5-102, 1924). A. Dastre's article in C. Richet's *Dictionnaire de Physiologie*, vol. 2, pp. 85-90, Paris, 1897, is valuable for its extensive bibliography. M. Berthelot's funeral address (M. Berthelot, *Science et Morale*, Paris, 1897, pp. 265-276) gives few facts, but an excellent picture of the "climate" of P. Bert's politico-scientific group. Berthelot himself was at that time Minister of Education and the successor of Bert in his fight for lay education. P. Bert's son-in-law, J. Chailley-Bert has published a little monograph: *Paul Bert au Tonkin*, Paris, 1887. The rest of the material consists of the traditional obituaries, short brochures for popular consumption or the usual notes in encyclopedias.

lege of having been "discovered" by them. But second-rate men often deserve attention not only because they are as indispensable for the total picture of a period as are the first-rate men, but also because these second-rate men sometimes actually are of the stuff of first-rate men, and it is rather the accident of birth, the fact that they were born too late to be part of one creative generation and too early to be part of the next creative generation, which condemns them to become second-rate men, "pupils" instead of "masters." Studying Paul Bert's life and work one cannot help feeling that he is such a man and that this time the blind chance of history has thrown the spotlight on a worthy subject who for a long time had been undeservedly forgotten.

Paul Bert, born in 1833, belonged to the generation born between 1830 and 1840, a generation with its own characteristics, but a typical "in between" generation, especially as regards the two fields in which Bert was active: science and politics. The generation of "founders," of "fathers," of those who laid the foundations on which men of the 30's built, the generation which actually developed and gave the classic expression to the religion of the 19th century, the religion of science,[3] was the generation born, roughly speaking, between 1815 and 1825. It was the generation of Claude Bernard (1818) and Pasteur (1822), of Pettenkofer (1818), of Virchow (1821) and Helmholtz (1821), of Mendel (1822) and Huxley (1825), of Charcot (1825) and Berthelot (1827), of Billroth (1829) and Lister (1827), in medicine and science; of Flaubert (1821), Ibsen (1828), Tolstoi (1828) and the Goncourts (1822 and 1830), in literature; of Courbet (1819) in painting; of Taine (1828) and Renan (1823), of Marx (1818) and Spencer (1820), of L. H. Morgan (1818) and Bastian (1826), in the social sciences. Only to the generation born in the 40's and especially in the 50's: P. Janet (1855), S. Freud (1856), P. Ehrlich (1854), J. Loeb (1859), P. Duhem (1862), H. Poincaré (1854), in medicine and science; H. Bergson (1859), L.

[3] This expression at first may shock the reader. But the more philosophically minded men of this generation were not afraid to make this admission. To give only one example: Renan, speaking of his youth when his friendship with Marcelin Berthelot originated, says (M. Berthelot, *Science et Morale*, Paris, 1897, p. 51): "Deux ou trois mots que nous échangeames discrètement nous eurent bientôt prouvé que nous avions ce que crée le principal lien entre les hommes, je veux dire la même religion. Cette religion c'était le culte de la vérité . . . Ce que nous entendions par la vérité c'était bien la science." This fundamental question unfortunately cannot be discussed in more detail within the limits of this article. On this occasion I wish to express my gratitude to Dr. O. Temkin who in numerous discussions has helped me to a greater knowledge and understanding of the philosophical aspects of 19th century sciences.

Lévy-Brühl (1857), F. Boas (1858), in philosophy and anthropology; van Gogh (1853), Hodler (1853), Seurat (1859), in painting; only to these men was the opportunity given to make what within certain limits amounts to a new departure.

Paul Bert's generation, the generation of the 30's, is represented by such men as Haeckel (1834), Sir M. Foster (1836), Wundt (1832), Mach (1838), J. Cohnheim (1839), Edwin Klebs (1834), v. Leyden (1832), Naunyn (1839), Camille Flammarion (1842), in medicine and science; Zola (1840) and T. Hardy (1840), in literature; Pissaro (1830), Manet (1832), Degas (1834), Sisley (1839), Cézanne (1840), in painting; Jules Ferry (1832), Sadi Carnot (1837), Léon Gambetta (1838), in French politics. Not that this generation was lacking in brilliancy. On the contrary, it was this generation which, coming to the fore after the debacle of 1870, gave to a humiliated and beaten France one of the most brilliant and astonishing renaissances in history. But, except for the great impressionists, this generation was not original, it was a generation of "pupils." Bert and Cohnheim were such famous "pupils." The typical scientific idea of naturalism, of studying and describing men as animals, was by no means original with Zola. Gambetta and Jules Ferry built the republic in youth and vigor, but it was on the basis of the work of men like Raspail, Littré, Ledru-Rollin, Blanqui, etc., who, even when physically still alive, were broken by the defeat of their country and were worn and exhausted by the chain of revolutions which culminated in the Third Republic. The optimism of this generation was enormous and more spontaneous than that of any one of its teachers who had gone through frightful struggles to establish the new credo. This generation inherited, so to say, the belief in the certainty of progressive evolution. Claude Bernard's tragic mask is representative not only of his own "tourment" [4] but of the suffering of a whole generation. Pasteur, Charcot, Berthelot, Huxley, show the same scars of mental suffering on their faces. It is possibly more than an individual contrast and more than the simple expression of his actually very gay and frank temperament that even on official portraits Paul Bert looks so Rabelaisian, so lusty and cocky. At any rate, in our culture which, at least in its heroes, values more highly a tragic and split character, this is another reason to rank him second.

There are many other reasons why Paul Bert should have been forgotten and underestimated. As a scientist Bert was, of course, the pupil of

[4] See Pierre Mauriac's excellent essay "Le tourment de Claude Bernard" in Pierre Mauriac, Aux confins de la médecine. *Nouvelles rencontres*, Paris, 1930, pp. 161 ff.

Claude Bernard, even " the " pupil, fixed as such in the memory of people by L'Hermite's famous picture. He was the first assistant of Bernard when, in 1863, Bernard eventually obtained the means to have somebody share with him the " tanière obscure et humide " (P. Bert) at the Collège de France. To him Bernard ceded his chair at the Faculty of Science. To him he addressed the famous invitation " to leave his imagination outside together with his overcoat." Bert was among the few to ease the last hours of the great man, abandoned as he was by his pious family. He succeeded him as the permanent president of the Society of Biology (to be chosen to fill this office in this very important society from among competitors like Brown-Séquard, who only succeeded Bert, was perhaps the greatest and most cherished honor Paul Bert ever received). He wrote the official summary of Bernard's work. To Bernard he dedicated his first important book (*On Respiration*, 1870). Bert, who possessed to a high degree " la vertu de la reconnaissance " (Bérillon), far from correcting this picture of the eternal pupil, reinforced it by the worship he rendered to his dead master. The fact that Bert was active in politics also influenced his scientific reputation unfavorably; this was especially true outside France where this activity was completely misunderstood.. It is strange enough that the ability of Bert to do two or three things well (to write *Barometric pressure* as well as to introduce a new law or to pacify Indo-China in six months) in a world where only few people are able to do one thing well, did not increase his fame, but rather spoiled it. The very elementary fact that Bert died relatively young, at 53, when he had by no means given his full measure, when in politics he was perhaps only starting on truly original work, was extremely detrimental to his being remembered. Finally, Bert had the hard luck to make great physiological discoveries at a moment when scientific interest centered almost entirely on surgery and bacteriology, when Koch, Pasteur, Neisser, Eberth or W. A. Freund, v. Bergmann, Billroth, were the heroes of the day. His later occupation with anesthesia, hydroperoxide, disinfectants, shows a more or less unconscious, a more or less successful, tendency to adapt his work to the trend and fashion of the period.

Paul Bert came from Burgundy as did Claude Bernard and Pasteur, from the charming old little town of Auxerre in the Yonne Department. His father, the son and brother of cattle merchants, was first a lawyer himself, then a successful Bonapartist politician and civil servant. His mother was the daughter of another civil servant of Scotch extraction. The wealth of the family goes back to a maternal great-grandfather, Simon Boyer, who had become rich in buying up the possessions of the

Church during the revolution. This activity of an " accapareur " was perfectly legal and honorable, and it was the basis of many French bourgeois fortunes. It is typical of the bitterness of French political discussions that Bert, in 1880, had to go to court in order to clear the memory of Simon Boyer, and to defend himself against the slanderous accusation of being the great-grandson of a thievish monk. From the money he was awarded in this trial he founded a " prize in history." Paul Bert's only brother died in his youth from tuberculosis, as did his mother whom he lost when he was 13. While the father was a rather severe character, the mother seems to have been tender and unusually fond of pets which filled the whole house and early awakened the boys' sympathy and interest in animals. Paul Bert's health during his youth was rather delicate. He apparently was an ambitious and very temperamental child, full of pranks. He started the study of engineering, but his father forced him to study law (1853-1857). After traveling and hunting in Algeria in 1857—Paul Bert was an enthusiastic hunter—he came back to Paris and was eventually allowed to study medicine. His first great inspiration was the comparative anatomist, Gratiolet; but he was still spending much of his time in the gay distractions of the Quartier Latin, composing chansons, etc. Only in 1860, at the age of 27, did he settle down to systematic work. It would be utterly wrong to see in Paul Bert's long and varied studies anything " Faustian," as Berthelot's shifting from one science to another undoubtedly was. Bert's mind was early set towards science, ever since he had played in the " ménagerie " of his mother; the law episode was imposed upon him. He studied long, in the beginning because he enjoyed the student's joyous life thoroughly; later, because he wanted to have the best possible preparation as a scientist, and no financial necessity urged him to look early for a remunerative occupation.

Once set to work, Bert progressed quickly. In 1860 he became licencié ès sciences naturelles. In his examination he stubbornly defended his ideas concerning respiration against the examiner Claude Bernard. It is to the credit of both men that nevertheless they could afterwards become such close friends. In 1863 Bert graduated in medicine with a thesis on grafting of animal tissues, for which he obtained the prize in experimental physiology of the Académie des Sciences. After some hesitation he refused to make a rich marriage and to go into practice, and rather decided to continue his scientific career, and in the year of receiving his degree he became the assistant of Claude Bernard. In 1865 he married an 18 year old girl from Scotland, Josephine Clayton. The marriage was an extremely happy one; the Berts had three daughters: Henrietta, Pauline,

Léonie (for Léon Gambetta), all of whom married. In 1866 Bert became docteur ès sciences, with a thesis on the vitality of tissues, a continuation of his studies on grafting. From 1866 to 1867 he was professor of zoology at Bordeaux, the youngest occupant of an academic chair in France. In 1867, after the fall of Napoleon, Gambetta sent him as préfèt (governor) to Lille to organize national resistance and to purge the administration. After Gambetta's resignation, Bert returned to Paris and it is typical of Bert's character that he immediately took up teaching again in the midst of the shooting of the Commune. From 1872 to 1885 Bert combined the duties of a deputy and a professor of physiology. In 1875 for his work on barometric pressure he received the grand prix biennual de l'Institut, one of the highest scientific honors given before him to men like Thiers, Würtz, Guizot. In 1881 he entered the Academy of Sciences. In 1881-1882 he was minister of education in Gambetta's short lived Grand Ministère. After Gambetta's death in 1883 he devoted himself more and more to colonial problems and in consequence was sent in 1886 to Tonkin and Annam as resident general. After six months of extremely successful activity he died from dysentery at Hanoi in November, 1886.

In his short life Paul Bert produced an amount of scientific work truly impressive by both its quantity and its quality. He left about 200 memoirs, books, articles and other communications. Within the limits of this short note we are, of course, able to give but the barest outline of his accomplishments. During his travels in 1857, observations of Arabs who playfully transplanted tails in living rats first suggested to Bert his work on the grafting of animal tissues. The results of his experiments were published between 1863 and 1866, and had immediate repercussions in the work of surgeons done during the following war; the pioneer character of these studies has been gratefully acknowledged by no less a person than A. Carrel. Bert also experimented on blood transfusion, which indeed is a kind of grafting. Bert developed the study of grafting into a study of general physiological problems, the influence of the milieu on the vitality of tissues, a typically Bernardian way to see the question.

The physiology of respiration occupied Bert practically throughout his whole scientific life. As early as 1859 he had worked on the problem of asphyxia. The bulk of his work on respiration was published between 1864 and 1870, starting in 1864 with an inquiry on the respiration of batrachians, and culminating in 1870 in his 580 page book: *Leçons sur la Physiologie comparée de la Respiration.*

Studies on respiration and an interest in the work of Dr. Denis Jourdanet led Bert to his studies on the influence of changes in barometric pres-

sure on the living organism, which he published between 1870 and 1885, and the essentials of which are incorporated in his *Barometric Pressure* which appeared in 1878, the year of Bernard's death, and which is now translated into English. Except for the ignorant anonymous who wrote Bert's obituary in the *Lancet* and who did not know anything about Bert's work, there has never been the slightest doubt that Bert's work on barometric pressure was his greatest accomplishment and his book on this subject, his *magnum opus.* Bert's contemporaries, historians, physiologists who know their literature, even the authors of doctors' theses, the numerous obituaries and notes in dictionaries and encyclopedias on Bert, by authors like Dastre, Bérillon, Garrison and even de Cyon,[5] all agree on this point. As there seems to exist some confusion as to when Bert actually started his work on barometric pressure, we should like to draw the attention of the reader to the fact that already in his book *On Respiration,* written in 1868 and published in 1870, Bert in the 13th chapter (p. 124) deals with this question. He outlines Jourdanet's theory of anoxemia in high altitudes, and not only develops a detailed plan as to how the question must be examined experimentally (the plan he actually follows in his book of 1878), but also reports some experiments with dogs. It is likely that Bert was interested in the problem even before 1868, and that for more than purely scientific reasons. In 1861, Dr. Denis Jourdanet published the first of his six books [6] on the medical implications of high altitude climate in which he developed his theory on anoxemia, later proved experimentally by Paul Bert.[7] When in the next year Napoleon

[5] E. de Cyon (née Elie Zion) wrote the article on Bert in Hirsch's *Biograph. Lexikon der Hervorragenden Ärzte aller Zeiten und Völker,* Wien, 1884, vol. 1, p. 427-28. In this article de Cyon, a sound physiologist himself, objectively evaluates Bert's scientific achievements but on the other hand proffers most violent political and personal slander against Bert, thus adequately reflecting his own curious personality. De Cyon, who in his youth had been one of the most promising physiologists, greatly praised by Claude Bernard, turned from Judaism and Lassalleanism to anti-Semitism and became a Czarist agent and disreputable financial and political adventurer in Paris. There are even good reasons to see in him the author of the notorious "Protocols of Zion." De Cyon hated Bert particularly since Bert, drawing attention to de Cyon's moral character, had made it impossible for him to obtain a professorship in France which de Cyon coveted. It seems that the collaborators of old Hirsch were still stranger than those of the Lancet! As Bert's case shows, editors indeed cannot be too careful in the choice of collaborators. There is little doubt that de Cyon's miserable article greatly influenced the judgment of historians (e. g. Garrison) in regard to Bert. The facts concerning de Cyon's mysterious life are admirably presented in an article of Dr. Solomon R. Kagan, *Medical Leaves,* Chicago, 1942, vol. IV, pp. 138-145.

[6] *Les altitudes de l'Amérique tropicale comparés au niveau de la mer au point de vue de la constitution médicale.* Paris, 1861.

[7] Denis Jourdanet (born in 1815) practised for many years in Mexico and became

III started his ill-fated Mexican adventure, which had such strange repercussions in the paintings of Manet and Henri Rousseau, Jourdanet's books, pointing out the unhealthiness of the Mexican climate, became a weapon in the hands of the opposition to which Bert belonged.

Bert's classic starts out with a historical section of 500 pages in which he reveals himself as an accomplished historian, no less fond of historical studies than his friend M. Berthelot. As a matter of fact, his description, neither dry nor loquacious, is so thoroughly done that nothing more has been added by later historians and many have drawn freely from Bert without, however, giving him due credit. Lately somebody carried his devotion for Bert and his " discrétion " so far as to copy, without mentioning the source, a harmless mistake in addition together with the passage from Bert (translation, p. 196). Bert first reviews the history of mountain climbing and mountain disease from the 16th century up to 1878. We hear about the hardships undergone by men like Bouguer, Borelli, Spallanzani, de Saussure, in fighting the mountains, the sickness itself and the problem it presented. A short history of balloon ascension follows. Bert then examines the theoretical explanations of, and experiments on, decompression, from Boyle to Jourdanet, digging up such valuable contributions as those of Cigna, Legallois, Brachet, Fernet. In spite of his feelings against the victors of 1871, he is perfectly objective towards their work, especially that of Hoppe. Only once (p. 522) does he explode in a well justifiable Philippic against the " charlatanism of decimals which leads to claim exactness for the thousandths in a number which is wrong beyond the units," a charlatanism which is " common on the other side of the Rhine." Unfortunately Bert's warning has hardly been heeded by anyone and in the progress of evolution this delightful " exactness " has become rather universal together with a general fetishistic devotion to numerals. As Bert deals in his book not only with decompression but also with high pressure, the historical part closes with a no less thorough history of diving bells and suits, which forms an important chapter in the history of occupational diseases, and with a history of low pressure medical apparatus and the theories and experiments related to both phenomena. Bert's historical study is also significant because it proves that medical history, written by the right man and in the right spirit, can become a

interested in the medical consequences of high altitude climate. Besides his medical books he published the first French translation of Bernal Diaz del Castillo. He furnished Bert with the considerable sums necessary for his experiments, and without Jourdanet, to whom the *Barometric Pressure* is dedicated, Bert probably would never have been able to carry through his research on barometric pressure.

living and valuable tool for tackling actual medical problems. 450 pages are filled with the record and analysis of Bert's own 668 experiments. Part III analyzes the findings of recent authors and brings Bert's own summary and conclusions.

It is obvious that a detailed analysis of Bert's experimental work does not lie within the limits of this article. It should be done by somebody who is a specialist in the field of respiration physiology. Undoubtedly he will realize that our knowledge of alveolar pressure, our technique of blood chemistry, have improved in many details. But the writings of so versatile an experimental genius as Bert without doubt will also suggest to him many sound and new ideas and he will probably express astonishment at the many unnecessary experiments that have been performed during the last 60 years by men unfamiliar with Bert's work, thus "solving" problems Bert had solved long ago. All I wish to do here is to draw attention to the fact that Bert did much more than clear up the riddle of mountain sickness and the accidents of high altitude flying, as even contemporary reports on Bert's work are often wont to state.[8] His answer to this question is only the first of his 10 conclusions:

"A. The diminution of barometric pressure acts upon living beings only by lowering the oxygen tension in the air they breathe, and in the blood which supplies their tissues (anoxemia of M. Jourdanet), and by exposing them thus to the dangers of asphyxia" (Eng. transl., p. 1037).

But conclusion B, containing Bert's discovery of oxygen poisoning, is hardly of less theoretical and practical importance.

"B. The increase in barometric pressure acts only by increasing the oxygen tension in the air and in the blood. Up to about three atmospheres, this increase in tension results in somewhat more active intra-organic oxidations. Beyond five atmospheres, the oxidations diminish in intensity, probably change in character, and, when the pressure rises sufficiently, stop completely. The result is that all living beings, air-breathing or aquatic, animal or vegetable, complex or monocellular, that all anatomical elements, isolated (blood corpuscles, etc.) or grouped in tissues, perish more or less rapidly in air that is sufficiently compressed. The only

[8] One of the fairest judgments on Bert's accomplishment is that of J. S. Haldane: "The foundations of our scientific knowledge of the physiological effects of low atmospheric pressures were laid broad and firm by the investigations of Paul Bert, which were collected together in his book: La Pression barométrique. This book also contains the observations of Paul Bert on the effects of high atmospheric pressures, which he was the first to interpret clearly. Paul Bert's conclusions remain valid up to the present day, though they have been amplified and extended by later work" (J. S. Haldane and J. G. Priestley, *Respiration*, New Haven, 1935, p. 327).

exception to this generalization is the spores of certain microscopic organisms. For the higher animals, death is preceded by tonic and clonic convulsions of extreme violence . . ." (p. 1036).

Conclusion E, the general law resulting from these two far-reaching discoveries, also should not be overlooked:

"E. In a general way, the benign or harmful gases (oxygen, carbonic acid, etc.) act on living beings only according to their tension in the surrounding atmosphere, a tension which is measured by multiplying their percentage by the barometric pressure. The increase of one of these factors can be compensated for by the decrease of others" (p. 1037).

Conclusion G, which explained the numerous fatal accidents of divers and workers in diving bells and when applied in practice led to slower decompression and the application of methods of treatment indicated by Bert, made him the benefactor of thousands whose lives he saved, and alone would give him a lasting place in medical history:

"G. Sudden decompression beginning with several atmospheres has an effect only by allowing to return to the free state the nitrogen which had become dissolved in the blood and the tissues under the influence of this pressure" (p. 1037).

In reading Bert's monumental book, one feels the same continuous "growing of respect and admiration for him" that his faithful translators, Dr. and Mrs. Hitchcock, experienced. And when one realizes that in addition to a brilliant and deep intelligence an enormous amount of work was necessary to compose this book; that this painstaking historical research, these hundreds of experiments were performed by a man who at the same time was a busy teacher and most actively engaged in politics, one feels simply overwhelmed. It is true, Bert paid dearly for his labors: his gay character changed to brusqueness, and constant overwork probably laid the foundations for his early death.

Bert applied the results of his experiments on the tension of gases to the field of anesthesia. In 1866 he had already elucidated another aspect of this problem: the initial excitation. Later, between 1878 and 1885, he was one of the first to work with mixtures of gases under pressure. His brilliant discoveries earned for him a prize from the University of Edinburgh. Though his methods are now outmoded as we have better and cheaper apparatus, his work remains important and valuable pioneer work.

Impressive as these accomplishments are, it should not be forgotten that Bert, under Gratiolet, started out as a comparative anatomist and zoologist and never abandoned research in this field. In 1864 he published his

Catalogue méthodique des animaux sauvages de l'Yonne. He used his years in Bordeaux for physiological and anatomical studies on fishes in the region of Arcachon. From 1867 to the time of his death he worked on the varied actions of the different bands of the spectrum on plants and animals. Well known are his experiments on the chameleon. His work on the Mimosa (published between 1867 and 1870) is part of this research. It brought him unexpected success as governor general. When meeting Norodon, King of Cambodia, he explained to him the mechanism of the giant Mimosa surrounding the king's palace. The King, in accordance with Chinese tradition, judged the statesman after his scholarship and became his friend, therewith also changing from an enemy of France into her friend. It is interesting that from these studies concerning the effects of light Bert concluded the practical usefulness of exposing the body to the sun.

That Bert was by no means infallible and sometimes made great blunders—such as opposing in 1876 Koch's results in experiments on anthrax [9] although Pasteur accepted them—need not be hidden. History proves abundantly that this trait unfortunately is common to all men, even the greatest.

Any evaluation of Bert which would neglect his political activities would not only be incomplete but fundamentally false. In 1863 Bert wrote in a letter: " Avant d'être naturaliste je me sens citoyen." And even though death robbed him of the opportunity to complete his political work and to harvest the fruits of his political labors, it is still true that Bert was one of the founders of the Third Republic, and accomplishments which now are usually associated with the names of happier men who outlived him are fundamentally his.

The combination of medico-scientific work and political activity is much more often encountered in the history of French Republicanism than in the history of any other country. Suffice it here to remind our reader of the names of Bailly, Barbaroux, Brissot, Fourcroy, Guillotin, Levasseur, Marat, for the First French Republic; for the Second, of Blanqui, Victor Baudin (the martyr of 1851), Buchez, Bixio, Ducoux, Littré, Raspail, Trélat, Trousseau, Maissiat; for the Third Republic of Paul Bert, Marcelin Berthelot, Clemenceau, Combes, Lafargue, Vaillant. I have dealt elsewhere with the phenomenon of the " physician-politician " on a general and international scale,[10] and I therefore abstain here from gen-

[9] See F. H. Garrison, *Introd. History of Medicine,* Philadelphia, 1917, p. 612.

[10] See Ackerknecht, E. H., *Sudhoffs Arch. Gesch. Med.,* vol. 25, pp. 71-89; see also R. Trisca, *Les Médecins Sociologues et Hommes d'État,* Paris, 1923.

eral discussion of the question. One of the foremost reasons for the frequency of " scientist-politicians " in France seems to me the fact that the " religion of science " in France was supported by the masses as it was in no other country. Moreover, Free Masonry gave to the " religion of science " an organization as is not to be found elsewhere. The scientist no longer lived in splendid isolation, nor was he only influential in a selected circle. Rather, he had mass support; he had the possibility and, to a certain extent, even the moral obligation to go into politics and to put his theories into practice.

In politics Bert's name is closely connected with the name of Léon Gambetta, who was born later than Bert and died before him. Bert's is not the only scientific name connected with that of Gambetta; indeed Charcot, whose stepdaughter married Waldeck-Rousseau, owed his chair for nervous diseases mainly to Gambetta. Gambetta made Bert préfèt, minister, included him in the intimate circles that often met for lunch (" les déjeuners corrupteurs ") while Gambetta was President of the Chamber in 1879-81,[11] he called Bert's daughter Léonie his " filleule laique." Bert's contributions to Gambetta's newspaper *La République Française*, published between 1878 and 1884, fill no less than seven volumes. As Gambetta's name seems to be connected abroad with " fiery radicalism," we should like to remind the reader of the fact that in France his group bore the less exciting title of " opportunists," but it is true that Gambetta was a staunch defender of the Republic and coined the slogan " Le cléricalisme, voilà l'ennemi."

Bert's main battlefield was the field of education. It is not surprising that a university professor, if he turns to politics, should be interested in university education—the founding of the new Universities of Lille and Lyon is mainly Bert's work. But his interest in education was broader and deeper. As a champion of democracy he knew that democracy presupposes education. As a believer in science as the ultimate truth, he had to fight for science as the basis of education. " Les sciences peuvent seuls enseigner la non-credulité sans enseigner le scepticisme, ce suicide de la raison " (P. Bert). Therefore Bert relentlessly struggled for compulsory free and lay instruction, a struggle which was won only after his death. Therefore he fought for the admission of girls to high schools. Therefore he sacrificed his valuable time and wrote a number of new schoolbooks conforming to the spirit of lay education. Therefore he had to fight the Catholic Church and its orders, especially the Jesuits, their tremendous economic power and their interference in education.

[11] Joseph Reinach, *La Vie Politique de Léon Gambetta*, Paris, 1918, p. 89.

In countries where Catholics are a minority without fixed political tradition this struggle may easily appear quixotic or odious. But in France and some other Latin countries it is neither; it is one of the basic features of political life. Today when several Latin countries in Europe and elsewhere are ruled by governments sponsored by the Catholic Church and thus clearly illustrate the political ideas of the Church where the Catholics are the majority, this struggle has perhaps become better comprehensible to the Anglo-Saxon observer. We devote some lines to this problem as an understanding of it is indispensable for an understanding of Paul Bert. The history of party life in the Third Republic only *appears* to be terribly confused. Fundamentally, it seems to me, there were but two parties and creeds: the Church and the Free Masons. Wherever the individual was placed on the motley and ever changing map of French political parties of the right or left, his basic loyalty belonged to one of these. This rôle of ideological and political counterpart of the Church and protagonist of Republicanism also explains why Free Masonry assumed its conspirative character (e. g. although Bert certainly was a Free Mason, none of his biographers states it expressly) and why it was bitterly persecuted in Italy, Spain and France. It also explains phenomena so bewildering to the foreigner as the heated discussions about the attitude taken by famous men such as Claude Bernard in their last moments about provisions for their burial, which both parties regarded as the supreme test of loyalty towards one of the two "religions." This explains such typical facts as the polarization of the French village around the teacher on the one hand, the priest on the other.[11a] The Catholic Church in France, which had been the backbone of the counter-revolution (Vendée) in the 1790's, throughout the 19th century continued to side with the monarchies, in which it controlled such key positions in society as public instruction, hospitals,[12] and the army. The example of Lamennais, at whose bier also a battle was almost fought, had early shown how the church reacted towards attempts to combine dissident political and social concepts with the Catholic faith. The attitude of the Church in the Dreyfus affair in the 1890's showed her still uncompromising in her hatred of the Republic. If the Third Republic wanted to live, then it had to drive the Church from all key positions. That is why "clericalism was the enemy." If Paul Bert wanted to realize his

[11a] See for this whole complex Zola's last novel *La Vérité* (1902).

[12] The dangerous consequences that might result from the influence of Catholic Sisters on hospital management became graphically clear in the bitter fight Desault had to undergo, primarily in defense of his right of clinical teaching. See L. McAuliffe, *La Révolution et les Hôpitaux*, Paris, 1901, p. 78 f.

ideals he had to fight the educational aspirations of the Church and its orders, the exemption of clerics from military service, etc. Bert did so primarily not because he was insensitive to religious feeling. That in Indo-China he abolished the glorious military tradition of quartering horses and troops in temples bears witness to his respect for religion. It was a political fight which he undertook in France, inevitable for the republican and believer in science.[13]

Already during Bert's lifetime a rather stupid legend was spread that he had "spoiled his scientific career" in going into politics, that he had "abandoned science for politics," that he "tried to return to science" which in reality he had never abandoned; he was told that "a scientist must not mix in politics." Bert felt deeply wounded by these assertions "more perhaps than it suits a philosopher resigned to human jealousies."[14] There is a continuous tendency to "interpret" the life of a scientist-politician in this way. Some years ago I dealt with similar attempts to distort Virchow's life history.[15] While such an attitude is perfectly understandable in political enemies, it is inadmissible for historians who pretend to judge according to the evidence; it deprives its adherents of any deeper understanding of the "scientist-politician" whose political activity is not accidental, but necessarily results from fundamental beliefs also indispensable for his scientific accomplishments. After all, neither Paul Bert nor Virchow, nor men of later generations up to Masaryk and Smuts, have any reason to be ashamed of their records as scientist-politicians. The least one can say is that they have not done worse than others and that their record does not confirm the widespread prejudice that ignorance is the best preparation for the management of public affairs.

In Paul Bert's case what is the evidence concerning his "abandoning science for politics," etc.? He was as genuinely a politician as he was a naturalist. After all, he was the son of a politician and grew up in a political atmosphere. His law studies, afterwards so useful to him as deputy, strengthened these tendencies. In 1863, in the midst of his first scientific successes, he wrote the famous sentence: "I feel that I am first a citizen and then a naturalist." In 1863 he published his first book: *Le permis de*

[13] Bert himself testified to this fact by distinguishing between Catholics whose rights and opinions he respected and the clericalism which he opposed. "Les catholiques sont des citoyens qui ne demandent à la société civile que de les protéger dans le libre exercice de leur foi. Le parti clérical demande à la société civile à se soumettre aux dogmes du catholicisme" (in P. Bert, *Le Cléricalisme*, Paris, 1900, p. 237).

[14] Berthelot, Funeral address, *l. c.*, p. 269; Bérillon, *l.c.*, p. 107, records similar reactions of Bert.

[15] Ackerknecht, *l. c.*, p. 80 ff.

chasse (Auxerre, 1863), and it was a political book, thoroughly liberal in character. In Bordeaux, three years before he " officially " entered political life, he started writing popular books on science with the aim of improving lay instruction of children and adults. In Bordeaux he lectured before the railroad workers. That he did not do any other political work at that time is due to the fact that there was neither the urgent need nor the opportunity to do so. Both were given by the debacle and the revolution of 1870. Then occurred what Berthelot related at Bert's grave: " C'est sous le coup du malheur, au moment de la catastrophe et de la ruine de la patrie que nous sortimes de nos laboratoires pour apporter notre secours à la France vaincue et demembrée." [16]

From then on, during the last 16 years of his life, Bert was uninterruptedly engaged in politics. And during these very 16 years he produced without interruption the greater and better part of his scientific work: *On barometric pressure, On anesthetics, On the effects of light and colors on plants and animals.* That is the evidence, and Dastre has characterized the true situation rather well when he speaks of a " parallelism " in Bert's political and scientific work. Both came from the same source and aimed at the same goal.

Bert's most original political achievement undoubtedly was his activity as a colonial administrator in Indo-China. This was not a pure improvisation. Bert was born when France, after the loss of the first, started building a new colonial empire. He always supported the new colonial orientation. From his extensive travels in North Africa from 1857 on, he knew the practical aspects of colonial policy. Thus it was no wonder that Jules Ferry, whose political interests were also divided between education and colonial expansion, chose him as resident general for Tonkin and Annam when Tonkin was practically unpacified and Annam in open revolt. Bert had not only to face the opposition of the natives, but also that of the French military authorities and bureaucrats who opposed his idea of a protectorate and copartnership with the Indo-Chinese in the development of the country and fostered ideas of annexation, centralization, and assimilation, ideas whose promulgation had led to the frightful situation. In Annam, Bert came to terms with the literati-mandarins, the respected rulers of the country. In Tonkin, on the contrary, where the literati were hated foreigners, Bert based his rule on the popular forces which he strengthened by social reforms and by erecting an academy to educate his own " literati-mandarins." He established—a thing unheard of in the history of colonization—a council with elected representatives from each

[16] Berthelot, *l. c.*, p. 270.

province, most members being simple peasants. He established no fewer than 138 schools in Tonkin. In all these revolutionary changes Bert never neglected the respect due to the natives' adherence to ceremonials and native institutions, laws, etc. Even on his death bed he dreamed of giving water-generated electricity and light to his capital Hanoi. The result of his audacious policy which had seemed sheer madness to the "experts" was that Bert left to his successor a Tonkin and Annam "pacified and organized as no other French colony was at that date." [17] The Australian historian, S. H. Roberts, summarizes Bert's work as follows:

> In the few months before his death Bert had demonstrated the practicability of the protectorate scheme and had carried out a policy which made him a tradition in colonial annals. Indo-China in these months of 1886 shares with Madagascar under Galliéni and Tunisia under Cambon credit of being the most successful episode in French colonization: and Bert was directly the father of that scheme which went through Galliéni to Lyautey and through him to the present generation of colonial administrators. Paul Bert, in short, had an influence out of all proportion to the changes he introduced or the actual events of his administration. He became a formative factor in the shaping of colonial policy and his name a tradition,—and therein lies his real importance.[18]

There is little doubt that today Paul Bert's name and bust have been removed from the college of the little town in Burgundy where he started on his meteoric career, removed by those who, gambling on the defeat of their own country, tenaciously prepared this miserable victory. But Paul Bert's resurrection far beyond the oceans also foretells his resurrection in that little spot of earth in which he was rooted so deeply. And since his resurrection will coincide with that of his unhappy and beloved country, the man who was first a citizen and a patriot and only then a naturalist, will regard this as his greatest triumph.

[17] S. H. Roberts, *l. c.*, p. 445.
[18] *Ibid.*, p. 439.